

## Tuneable planar photonic crystal devices

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Recently there has been a growing amount of attention devoted to tuneable photonic crystals (PhCs) where the optical response of PhC structures can be dynamically modified: This emerging research topic may have a huge technological impact in various application fields [1]. Preliminary studies on planar PhCs show the potential of air-hole infiltration with a tuneable refractive index material [2]. For instance, a PhC microcavity with a quality factor  $Q \approx n/\Delta n$  can be used to measure a variation  $\Delta n$  of the refractive index of the in-filled material, whilst the selection of single DWDM channels with a 100 GHz spacing translates into  $\Delta n/n \approx 5 \times 10^{-4}$ . We will show how infiltrating PhC devices with a synthetic organic material allows the trimming or tuning of their optical properties. Planar PhCs were infiltrated with liquid crystals (LCs) in a suitable vacuum chamber specifically designed to empty the gaseous content of the holes, to clean and, when necessary, to chemically activate the device surface, thus improving the LC wettability [3]. The infiltration efficiency was assessed by SEM and optical measurements. Finally, the possibility of tuning the optical response of PhC devices (*e.g.* cavities, waveguides, etc.) by an external perturbation was investigated. This dynamic change was induced by either temperature or optical tuning of the LC refractive index. In the latter case a photochromic LC mixture was used. Optical measurements were compared to theory in order to deduce the in-filling efficiency, the LC refractive index, and the orientation of the molecules inside the holes.

[1] See for ex. M. Loncar *et al.*, *Appl. Phys. Lett.*, **82**, 4648 (2003); Pat. WO 2004/100330.

[2] J. Martz *et al.*, Invited pres. at *Optics & Photonics – NP203* (San Diego, USA, 2005).

[3] J. Martz *et al.*, *Langmuir*, **20**, 11428 (2004).